

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) TRAVELLING-SCREEN LIQUID FILTER

(71) We, AMERICAN AIR FILTER COMPANY, INC., a Company organised and existing under the laws of the State of Delaware, United States of America, of 215 Central Avenue, Louisville 8, Kentucky, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a liquid filter assembly for removing contaminant particulates from liquids in a liquid tank.

Previous liquid filter assemblies for removing contaminant particulates from liquids in a liquid tank have employed filter screens of a continuous endless nature. Furthermore, conveyor means forming part of the filter assemblies have been exposed to the contaminated liquids to be treated so as to cause an acceleration of the wear of the conveyor means. The continuous endless screens have been prone to failure as a result of expansion of the conveyor means by which they are mounted. Although the mounting of sectional filter screens on endless conveyor means has been broadly known, such sections in the past have been mounted for the most part in edge-to-edge relationship without allowance for expansion and with the sections necessarily being of short breadth along the line of conveyor travel to permit passage of the sections from one flight to the other. In some instances, although the sections of the filter screen have overlapped, either the sections have been fastened firmly at both leading and trailing edges in the direction of conveyor movement or have been pivotally fastened along one of such edges with the other edge dragging in the lower flight stage of the filter screen during operations so that the sections are susceptible to frictional wear.

The present invention provides a liquid filter assembly for removing contaminant particulates from liquids in a liquid tank, which assembly comprises longitudinally ex-

tending spaced opposed wall members which are to be positioned in said liquid tank; opposed conveyor means mounted on each of the said wall members in endless looped fashion; a plurality of spaced screen support members mounted on said opposed conveyor means; one or more flexible filter screen members having leading edge, body and trailing edge portions mounted in looped fashion about said spaced screen support members with said leading edge portion of the or each filter screen member being fastened to one of said support members, the body portion resting in free fashion on successive support members, and the trailing edge portion overlapping the immediately successive leading edge portion to permit expansion of the one or more filter screen members with expansion of said conveyor means; a plurality of spaced restraining members mounted on said opposed conveyor means to restrain said free portion of the or each filter screen member from falling off said support members; sealing means extending between the margins of the or each filter screen member and adjacent wall members to provide a clean liquid plenum determined by said looped filter screen member or members, said sealing means and said opposed wall members; and clean liquid conduit take-off means communicating with said clean liquid plenum.

Preferably, the sealing means extend along the outer face of the or each filter screen member between the margins thereof and the inner faces of the adjacent wall members to provide a clean liquid plenum determined by said looped filter screen member or members, said sealing means and said opposed wall members, with the opposed conveyor means disposed within said clean liquid plenum.

Usually, the conveyor means will be mounted on the inner faces of said wall members.

Preferably, the screen support members comprise spaced wall members with the opposite ends thereof mounted on said opposed conveyor means, each of said bars having a

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face leg lying substantially in the plane of travel of said conveyor means and an intumed leg member normal to said face leg with the leading edge of the or each filter screen member being turned at right angles to fasten to said intumed leg of one of said spaced bars and the body portion of the or each filter screen member resting freely on successive face legs of said transversely extending spaced bars.

The spaced restraining members may comprise rods transversely extending between said wall members immediately above said screen support members in spaced relation therewith with the opposite ends thereof mounted to said opposed conveyor means, said rods having flat portions at opposite ends thereof which are engaged by said sealing means. The spaced opposed wall members may be provided along their inner faces with looped guide channels to receive and support said opposed conveyor means, said sealing means being disposed to seal said guide channels and conveyor belts in said clean liquid plenum.

The liquid filter assembly may include drive means connected to said conveyor means to drive the same. Preferably, each conveyor means is a link type conveyor means and is driven by sprocket drive means connected thereto.

The invention provides a liquid filter assembly which is straightforward and economical in construction, operation and maintenance, which permits usage with a wide range of filter screen media and a wide range of section lengths. Effective support of the filter screen section or sections can be provided along the entire length of the conveyor means. Further, the construction of the liquid filter assembly may permit for ready inspection and may allow movement of the overall assembly from one liquid tank to another.

So that the invention will be fully understood an example in accordance with it will now be described by way of example with reference to the accompanying drawings in which:—

Figure 1 is a schematic top plan view of a liquid filter assembly according to the invention incorporated in a liquid tank adapted to receive contaminant liquids to be treated;

Figure 2 is a side elevational view of the apparatus of Figure 1;

Figure 3 is a cross-sectional view taken in a plane passing through line 3—3 of Figure 2 disclosing the liquid filter assembly suspended in a liquid tank;

Figure 4 is an enlarged cross-sectional view of a portion of the apparatus of Figure 3, disclosing in detail the sealing arrangement for the endless filter screen;

Figure 5 is a cross-sectional view taken in

a plane passing through line 5—5 of Figure 4, and,

Figure 6 is an enlarged top plan view of a portion of the apparatus of Figure 4 disclosing the details of the overlapping filter screen arrangement and the hold-down device utilized.

Referring to Figures 1 and 2 of the drawings, a liquid filter assembly 2 is disposed in a liquid filter tank 3, the walls of the tank 3 being contoured to include a liquid treating section 4 and a contaminant removal section 6. Contaminant removal section 6 is provided with a contaminant outlet conduit 7 to which contaminant particulates separated by and remaining on the outside of endless screen filter 8 of filter assembly 2 are passed. Filter assembly 2 is suspended from tank 3 by means of suitable cross bars 9 and vertical suspension beams 11. The bars 9 are arranged to extend transversely across the open top of tank 3 and the suspension beams are each fastened at one end to the bars 9 and at the other end by means of suitable structural members 12 (see Fig. 3) to one of the spaced opposed side wall members 14 of filter assembly 2.

Side wall members 14 of filter assembly 2 are arranged to be spaced from the side walls of the tank 3 and above the bottom floor of such tank. The side walls 14 are contoured in accordance with the contour of the tank so that one portion of assembly 2 extends into the treating section 4 of the tank 3 to be below a preselected liquid level of the tank during filter treating operations (to allow filtered liquid to pass through the screen filter 8), and the other portion extends into the contaminant removal section 6 of the tank with the end extremity adjacent and above contaminant outlet 7, the contaminants on the outside of the screen filter 8 being removed as described below.

Provided along the inner facing of each of spaced walls 14 (Figure 4) by means of appropriately positioned and contoured right angle structural members 16 fastened to such inner wall face, are looped guide channels 17. The looped guide channels 17 which include upper and lower flights connected by end turn-around sections, serve to accommodate opposed spaced conveyors 18 which, as most clearly seen from Figure 6, are in the form of chains. Each conveyor chain 18 is comprised of a series of connected link members 19, the link members in turn being provided with rollers 21 which ride in the looped guide channels 17 (Figures 4 and 6).

As can be seen in Figure 2 of the drawings, a suitable sprocketed shaft 22 connected to a drive motor (not shown) can engage with the link members 19 of the spaced conveyor chains 18 to move them in an endless path about the looped guide

channels 17. Each of the link members 19 is provided with an inwardly directed shelf member 23 along the inner side thereof.

Referring to Figures 4 and 6 of the drawings, a plurality of spaced right angle bars 24 are arranged to transversely extend between the side wall members 14 with the opposite ends thereof mounted on opposed shelf members 23 of opposed links by suitable nut and bolt arrangements. Right angle bars 24 are provided between alternate pairs of opposed link members 19. A plurality of rods 25 are alternately arranged with the right angle bars 24 with their opposite ends connected in similar fashion by suitable nut and bolt arrangements to opposed shelf members 23 of other alternate pairs of opposed link members.

If desired, right angle bars 24 can be disposed between each of the successive pairs of link members — or in some other preselected arrangement in alternation with the support rods 25 — all in accordance with the dimensions of the overall assembly and the weight of the screens to be supported. It will be noted that each of the right angle bars 24 is provided with a face leg 26 which lies in the plane of travel of the conveyor belt and an intumed leg 27 which extends normal to face leg 26 (Figure 5).

The filter screen 8 advantageously is made up of a plurality of successive filter screen sections 28 which are mounted about the spaced right angle bars 24 and rods 25. Each of filter screen sections 28 includes a leading edge portion 29, a body portion 31 and a trailing edge portion 32, with the leading edge portion of each screen 28 being turned at right angles to fasten to an intumed leg 27 of one of the right angle bars 24 (Figure 5) by means of a suitable fastening arrangement such as nut and bolts or rivets. The body portion 31 of each of screen sections 28 rests freely on successive face legs 26 of successive bars 24 and on rods 25 alternately, with the trailing edge portions of the screens being arranged to overlap the leading edge portions 29 of an immediately successive screen section (Figures 5 and 6) to permit relative movement of the filter screen sections 28 with expansion of the conveyor chain 18.

If the filter screen is of short length, only one flat section need be used, such section being arranged in a loop with the opposed ends thereof in overlapping fashion and the leading edge only fastened to a bar 24. Further, the length of the sections can vary in accordance with the weight of the mesh and the overall weight and length of the filter belt needed the particular extent of overlap, of course, being sufficient to accommodate the anticipated wear of the belt.

To restrain the filter screen sections 28 so as to keep the free portions 31 and 32 of the

filter sections from falling off the support members as the endless conveyor belt turns about the end of the guide channels 17 as it passes from an upper flight to a lower flight, and vice versa, a plurality of spaced restraining rods 33 are provided. These rods 33 extend transversely between side wall members 14 in co-extensive fashion with right angle bars 24 so as to be immediately above the right angle bars in spaced relationship therewith with the opposite ends of the rods mounted on the opposed conveyor chains 18 in similar fashion as the bars so as to restrain the free portions of the filter screens.

The bars 33 are provided with flat sections 34 at the opposite ends thereof, these flat sections 34 being engaged by the edges of sealing strip members 36 to minimize the amount of leakage. The sealing strip members 36 (Figure 4) extend along the outer faces of the filter screen sections 28 between the margins thereof and the projected inlet faces of adjacent wall members to provide a sealed clean liquid plenum determined by the loop filter screen sections 28, the sealing strips 36 and the opposed wall members 14. Thus, the opposed conveyor chains 18 are disposed within a clean liquid plenum so that the chains are free from contaminants, thereby extending the life of the conveyor chains.

Referring to Figures 2 and 3 of the drawings it can be seen that suitable clean liquid outlets 37 communicate with the clean liquid plenum, clean liquid conduits 38 being provided to carry off the clean liquid for suitable use elsewhere.

From the foregoing description, it can be seen that the liquid filter assembly shown in the accompanying drawings allows for expansion of the filter screen with wear of the conveyor means, and also maintains such conveyor means in a clean plenum so as to increase the overall life of the conveyor means and the overall operating life of the assembly.

Finally, it will be noted that in order to enhance the gravitational cleaning of contaminants from the filter screen 8 as it rotates in a clockwise direction a suitable spray conduit 39 (Figure 2) is provided above the lower flights of the filter screen adjacent the contaminant outlet 7 of the liquid filter assembly.

WHAT WE CLAIM IS:—

1. A liquid filter assembly for removing contaminant particulates from liquids in a liquid tank, which assembly comprises longitudinally extending spaced opposed wall members which are to be positioned in said liquid tank; opposed conveyor means mounted on each of the said wall members in endless looped fashion; a plurality of spaced

screen support members mounted on said opposed conveyor means; one or more flexible filter screen members having leading edge, body and trailing edge portions mounted in looped fashion about said spaced screen support members with said leading edge portion of the or each filter screen member being fastened to one of said support members, the body portion resting in free fashion on successive support members, and the trailing edge portion overlapping the immediately successive leading edge portion to permit expansion of the one or more filter screen members with expansion of said conveyor means; a plurality of spaced restraining members mounted on said opposed conveyor means to restrain said free portion of the or each filter screen member from falling off said support members; sealing means extending between the margins of the or each filter screen member and adjacent wall members to provide a clean liquid plenum determined by said looped filter screen member or members, said sealing means and said opposed wall members; and clean liquid conduit take-off means communicating with said clean liquid plenum.

2. An assembly according to Claim 1 in which the sealing means extend along the outer face of the or each filter screen member between the margins thereof and the inner faces of the adjacent wall members to provide a clean liquid plenum determined by said looped filter screen member or members, said sealing means and said opposed wall members, with the opposed conveyor means disposed within said clean liquid plenum.

3. An assembly according to either of the preceding claims in which the conveyor means are mounted on the inner faces of said wall members.

4. An assembly according to any one of the preceding claims in which said screen support members comprise spaced right angle bars transversely extending between said wall members with the opposite ends thereof mounted on said opposed conveyor means, each of said bars having a face leg

lying substantially in the plane of travel of said conveyor means and an inturned leg member normal to said face leg with the leading edge of the or each filter screen member being turned at right angles to fasten to said inturned leg of one of said spaced bars and the body portion of the or each filter screen member resting freely on successive face legs of said transversely extending spaced bars.

5. An assembly according to any one of the preceding claims in which said spaced restraining members comprise rods transversely extending between said wall members immediately above said screen support members in spaced relation therewith with the opposite ends thereof mounted to said opposed conveyor means, said rods having flat portions at opposite ends thereof which are engaged by said sealing means.

6. An assembly according to any one of the preceding claims in which said spaced opposed wall members are provided along their inner faces with looped guide channels to receive and support said opposed conveyor means, said sealing means being disposed to seal said guide channels and conveyor belts in said clean liquid plenum.

7. An assembly according to any one of the preceding claims including drive means connected to said conveyor means to drive the same.

8. An assembly according to any one of the preceding claims in which each conveyor means is a link type conveyor means and is driven by sprocket drive means connected thereto.

9. A liquid filter assembly according to Claim 1 substantially as herein described with reference to the accompanying drawings.

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